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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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| In re application of: | ) | Group Art Unit: 1743 |
| Peter Lenehan | ) | Examiner: Lyle Alexander |
| Serial No.: 09/845,513 | ) | |
| Filed: April 30, 2001 | ) | June 20, 2005 |
| For: PORTABLE OXYGEN SENSOR ANALYZER | ) | Pasadena, California |

APPEAL BRIEF

The Commissioner is authorized to charge the $250 fee to file this Appeal Brief, as well as any other necessary fees, to Deposit Account No. 19-2090.

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## APPEAL BRIEF

Commissioner For Patents
Alexandria, VA 22313-1450

Sir:

## I. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences presently pending that are known to appellant or appellant's attorney.

## II. STATUS OF CLAIMS

This appeal is taken from the final rejection of March 11, 2005, by the Examiner of claims 1, 2, and 4-13. Claim 2 has been subsequently canceled. Claims 1 and 4-13 are pending in this application. The claims on appeal are presented in Appendix A.

## III. STATUS OF AMENDMENTS

An Amendment and Request for Reconsideration was filed in response to the Final Office Action of November 26, 2004, the Amendment canceling claim 2.

## IV. SUMMARY OF INVENTION

Applicant's invention relates generally to the field of vehicle emission controls

## V. THE ISSUES

1. Whether claims 4-13 are anticipated under 35 U.S.C. §102(b) by any of the Anderson, Bienkowski, Luchaco, or Ezoe et al. references.

2. Whether claim 1 is unpatentable over any of the Anderson, Bienkowski, Luchaco, or Ezoe et al. references alone or in view of the Zaleski reference.

## VI. GROUPING OF CLAIMS

The rejected claims do not stand or fall together. As discussed below, the patentability of the following groupings of claims should be separately considered:

Group I: Claim 1 (oxygen sensor analyzer having housing with keypad and display, operable in closed-loop mode, simulated oxygen sensor mode, and oxygen sensor test mode);

Group II: Claim 4 (oxygen sensor analyzer having electronic circuit for series-connection between an oxygen sensor and the on-board computer to which the oxygen sensor is normally connected, the analyzer having closed-loop and simulate modes of operation);

Group III: Claims 5 and 9 (oxygen sensor analyzer as in claim 4, with additional test mode in which sensor time-response is measured);

Group 1V: Claim 6 (oxygen sensor analyzer as in claim 5, with a stable ready condition signaled and time response being subsequently measured at engine operation passing from lean to rich);

Group V: Claims 7-8 (oxygen sensor analyzer as in claim 6, with the ready condition being inhibited until the engine operates more lean than the stable condition);

Group VI: Claims 10-11 (oxygen sensor analyzer as in claim 4, with plurality of indicators continuously activated in accordance with predetermined oxygen sensor signal levels); and

Group VII Claims 12-13 (oxygen sensor analyzer as in claims 4, 5, 6, 7, 9, and 10).

## VII. THE REFERENCES

A. The Anderson Reference

The Anderson reference discloses an automotive emission control system having a universal exhaust gas oxygen sensor located between series-connected upstream filter and downstream main exhaust catalysts, and a control system responsive to the sensor for adjusting the engine air/fuel ratio. Compensation for chemical aging of the upstream catalyst is obtained by adjusting an initial control loop gain based on empirically established rates of degradation of the upstream catalyst and the sensor, the loss in sensor gain with aging offsetting the effect of increased passage of noxious gaseous effects through the upstream catalyst. Applicant emphasizes that once the sensor of an operational system is installed and connected in the closed-loop system, *no testing of the sensor is disclosed.* Also, there is no description of "empirically determining the degradation rate of said sensor with normal usage reduces the gain of the sensor" (quoted from claim 26). A copy of the Anderson reference is in Appendix B.

B. The Bienkowski Reference

The Bienkowski reference discloses an oxygen sensor monitor having a plug power connection to a vehicle cigarette lighter socket and a lead for connection to the output of the installed oxygen sensor. The sensor output is buffered and compared with a 0.45 volt reference, an indicator light being responsive to the comparison. Normal closed-loop operation is evidenced by flashing of the indicator light at a low repetition rate (1-4 Hz). Applicant emphasizes that the indication is only whether the signal is above 0.45 volts (richer than stoichiometric) which gives virtually no information on sensor operation, e.g., how rich or lean, range of operation, or reaction speed. A copy of the Bienkowski reference is in Appendix C.

C. The Luchaco Reference

The Luchaco reference discloses a fuel injection system including a failure detection system for the exhaust gas sensor. The failure detection system includes a control circuit that enables failure detection when engine operating parameters such as temperature, fuel flow, RPM, and throttle setting are indicative of the engine being hot and idling for a sufficient period relative to thermal time constants. When enabled by the control circuit, a transition interval indicator determines whether sensor transitions are rapid (normal) or slow (abnormal), the abnormal condition being latched and suitably indicated to the operator. The output of the transition interval indicator also modifies the timing of a subset of fuel injectors to effect a periodically lean mixture. Applicant emphasizes that the failure detection system is effective for detecting essentially catastrophic failures under operation near stoichiometric (450mV), not over a full range of operation which is typically from below 175mV to above 800mV. A copy of the Luchaco reference is in Appendix D.

D. The Ezoe et al. Reference

The Ezoe et al. reference discloses a diagnostic monitoring device that measures the frequency of the feedback control signal of an engine air/fuel ratio control system to estimate the state of the gas sensor. In one embodiment, indicator lamps show whether the frequency is above or below a predetermined level; in another, whether the frequency is within a predetermined range is indicated. Applicant emphasizes that the monitoring device is operative only under specific operating conditions of the engine to produce an appropriate operating temperature of the sensor (such as 1900 < RPM < 2100 for one minute, and the engine being at operating temperature). The failure detection system is effective for detecting essentially catastrophic failures under operation near stoichiometric (450mV). Also disclosed is a tester for verifying that the internal resistance of the sensor (when disconnected from the control system) is within a predetermined range, such as between 100 k ohms and 500 k ohms. A copy of the Ezoe et al. reference is in Appendix E.

E. The Zeleski Reference

The Zeleski reference discloses a microprocessor-based tester that interacts with a vehicle's computer data bus to exercise various electronic subsystems and monitor responses thereto. A keyboard is provided for overriding pre-programmed diagnostics, and an alphanumeric display is included for showing test results. Passive testing of the engine control module is disclosed, wherein malfunction codes and diagnostic data are captured, scaled, and displayed. A copy of the Zeleski reference is in Appendix F.

## VIII. ARGUMENT - THE REJECTIONS SHOULD BE REVERSED

A. Introduction

As detailed below, the Examiner's rejections should be reversed because:

1. The Examiner's rejection of claims 4-13 under 35 U.S.C. §102(b) is improper:

(a) Each of the Anderson, Bienkowski, Luchaco, and Ezoe et al. references fail to disclose Applicant's invention.

(b) The claimed invention is patentably distinct from the references in that (i) the references do not suggest Applicant's invention; and (ii) dependent claims are directed to patentable subject matter.

2. The Examiner's rejection of claim 1 under 35 U.S.C. 103(a) is improper because none of the references, alone or in combination, discloses or suggests Applicant's invention.

B. The Examiner's Rejection of Claim 1 Under 35 U.S.C. §102(b) Is Improper

1. The rejection of claims 4-13 under 35 U.S.C. 102(b) is believed to be inappropriate because none of the Anderson, Bienkowski, Luchaco, and Ezoe et al. references nor any of the other references discloses any of the following:

(a) The combination of a housing having a keypad with plural keys and indicator lights, and operative to provide plural operating modes including (i) a closed loop oxygen sensor mode to show real-time dynamic operation of the oxygen sensor being tested; (ii) a simulated oxygen sensor mode, feeding simulated oxygen sensor signals to the vehicle computer while monitoring the sensor for reactions to the simulation; and (iii) an oxygen sensor test mode in which the engine is forced to run lean without injection of propane (claim 1);

(b) The combination of an electronic circuit for receiving an oxygen sensor signal and having a simulate output for connection to a vehicle on-board computer in place of the oxygen sensor signal, with logic for driving the simulate output in (i) a closed-loop mode, the simulate output directly following the oxygen sensor signal, and (ii) a simulate mode, the simulate output being driven arbitrarily in isolation from the oxygen sensor signal for forcing the

engine to run one or both of lean and rich, and a display for indicating the oxygen sensor signal (claims 4 and 12);

(c) The above combination with an additional test mode, the simulate output being driven arbitrarily in isolation from the oxygen sensor signal for forcing the engine to run lean, and the logic monitoring the time response of the oxygen sensor signal between lean running and rich running of the engine (claims 5 and 12);

(d) The above combination wherein the logic means signals a ready condition in the test mode when the engine reaches a stable lean condition, then enabling measurement of the time response of the oxygen sensor signal indicating operation passing from lean toward rich (claims 6 and 12);

(e) The above combination wherein the oxygen sensor signal has a range including a first value representing a lean condition, the ready condition being signaled only after a predetermined interval of operation with the sensor signal representing a more lean operating condition (claims 7 and 12); and

(f) The second combination above, including a timer for measuring an interval between the oxygen sensor signal having a first value representing a lean condition and a second value representing a rich condition, and circuitry for signaling a passing condition of the sensor if the measured interval is sufficiently short (claim 9); and

(g) The second combination with a plurality of indicators continuously activated in accordance with predetermined oxygen sensor signal levels.

It is respectfully submitted that none of the references anticipates Applicant's invention. As the CCPA has stated:

> "Rejections under 35 U.S.C. 102 are proper only where the claimed subject matter is identically disclosed or described in prior art

> (citation). In other words, to constitute an anticipation, all material elements recited in a claim must be found in one unit of prior art."
> In re Marshall, 198 USPQ 344, 346 (CCPA 1973).

It is clear that none of the references satisfies this test. Applicant emphasizes that as to the rejected claims 4 and 12, the references disclose nothing regarding a circuit driving an oxygen sensor input of a fuel injection system arbitrarily in isolation from the sensor. More particularly, the fuel injection systems of Anderson and Luchaco, and the monitoring device of Bienkowski, each always maintain a connection from the oxygen sensor to apparatus controlling air/fuel ratios, whereas Applicant's invention has at least one operating mode in which the simulate output to *the oxygen sensor input of the fuel system is driven in an arbitrary manner in isolation from the oxygen sensor*. The Ezoe et al. reference also apparently maintains this connection of the oxygen sensor to the apparatus controlling the air/fuel mixture, except when the impedance of the sensor is being measured, during which time the sensor input to the apparatus is open and, presumably, the engine is not in operation. More particularly, the additional gas sensor detector (Fig. 4) of Ezoe et al., while being connected to a switch for disconnecting the sensor from the feedback control (oxygen sensor input), that sensor input is left open, and is *not* driven in an arbitrary manner as claimed by Applicant. It is clear that this additional detector is used only for measuring the internal impedance of the sensor as disclosed at Col. 11, lines 25-29, and there is no monitoring of a sensor reaction to arbitrary driving of the sensor input by the claimed circuit. The apparatus of Ezoe et al., as well as those of Anderson, Bienkowski, and Luchaco, thus cannot be in anticipation of Applicant's claimed invention in that only Applicant provides both a closed loop mode in which the simulate output directly follows the sensor input, and an open-loop mode in which the simulate output is driven in an arbitrary manner in isolation from the sensor input. Further, none of the references discloses a display of

the oxygen sensor output, the additional detector of Ezoe et al. indicating only whether the internal impedance of the sensor is within a preset range.

2. No combination of the references renders the claimed invention obvious, in that none of the references, either alone or in combination, discloses or suggests Applicant's multiple modes of operation including the closed loop mode in which the simulate output directly follows the oxygen sensor input, and an open loop mode in which the simulate output is driven in an arbitrary manner in isolation from the sensor signal. Even consideration of the Zeleski reference fails to render Applicant's invention obvious in that Zeleski fails to disclose or suggest substitution of a simulated sensor signal for the oxygen sensor input to the on-board computer.

3. The dependent claims 5-11 and 13 are further believed to be allowable based on the subject matter of claims 1 and 12 from which they depend, because they further limit allowable subject matter, and because they contain additional limitations that are neither disclosed or suggested by the prior art as outlined above. More particularly, at least each of the rejected dependent claims 5, 6, 9, and 10 are believed to further patentably distinguish over the prior art. Claim 5 (and claim 9, dependent thereon) requires an *additional* test mode in which oxygen sensor time-response to a sudden change in air/fuel ratio is measured. Claim 6 (dependent on claim 5) further requires that after a stable ready condition of the engine is signaled, time response of the sensor is measured at the point of engine operation passing from lean to rich. Claims 7 and 8 (dependent on claim 6) further require the ready condition to be inhibited until the engine operates more lean than the stable condition. Claims 10 and 11 (dependent on claim 4) further require a plurality of indicators that are continuously activated in accordance with predetermined oxygen sensor signal levels. Finally, claim 13 (dependent on

claim 12) requires two predetermined values of 175 mV and 800 mV respectively to monitor the oxygen sensor's response time to the simulated input signals.

C. The Claimed Invention Is Patentably Distinct From The References

The rejection of claim 1 under 35 U.S.C. 103(a) is believed to be inappropriate because none of the Anderson, Bienkowski, Luchaco, Ezoe et al., and Zaleski reference, either alone or in combination, discloses or suggests the combination of a housing having a keypad of plural keys and indicator lights, being operative to provide plural operating modes, including (a) a closed loop oxygen sensor monitor mode for showing real time dynamic operation of the oxygen sensor being tested; (b) a simulated oxygen sensor mode in which simulated oxygen sensor signals are fed to the vehicle computer, the oxygen sensor being monitored for its reaction to the simulation; and (c) an oxygen sensor test mode in which the oxygen sensor is tested in response to the analyzer forcing the engine to run lean without requiring propane injection.

Claim 1 corresponds generally to the first two combinations outlined in the prior section (claim 4 as further limited by 5), with the additional limitations of a housing having a keypad with indicator lights. As discussed above, none of the references, either alone or in combination, discloses or suggests Applicant's combination which provides both a closed loop mode of operation, and an open loop mode with simulated oxygen sensor signals input to the vehicle computer. Also, the references fail to disclose Applicant's claimed device which shows in real time the dynamic operation of the oxygen sensor being tested.

As to this last point, the Anderson reference shows nothing about the operation of the sensor; the Bienkowski reference shows only whether the sensor signal is above or below 0.45 volts; the Luchaco reference discloses indication only of whether sensor transitions were abnormally slow, not real-time dynamic operation; and the Ezoe reference discloses indication of

whether the sensor output frequency is above or below a predetermined level (or within a range) - neither the frequency nor the level of the signal is displayed in real time.

The Zaleski reference discloses a test device (having a housing, keys and display) that is connectable only to the electronics data bus of a vehicle, but neither discloses nor suggests simulating oxygen sensor signals to the vehicle computer, the oxygen sensor itself being isolated from the data bus in that the engine control module (which would typically include a computer corresponding to the on-board computer recited in the preamble of Applicant's claim 1, the oxygen sensor being interfaced to that computer). Thus the device of Zaleski would be incapable of simulating oxygen sensor signals to the on-board computer as claimed by Applicant.

## IX. CONCLUSION

For the reasons presented above it is submitted that the Examiner was in error in rejecting claims 1 and 4-13; the rejections should be reversed; and these claims should be held allowable.

Respectfully submitted,
SHELDON & MAK

Date 6/20/05

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## APPENDIX A - Pending Claims

1. An oxygen sensor analyzer for use in testing the performance of an oxygen sensor comprising a portion of a vehicle emission system having an on-board computer, said oxygen sensor analyzer comprising:

a housing having a keypad, said keypad having a plurality of keys and indicator lights disposed thereon; and

a plurality of modes of operation, comprising:

a closed loop oxygen sensor monitor mode, for showing, in real time, the dynamic operation of the oxygen sensor being tested;

a simulated oxygen sensor mode, for simulating oxygen sensor signals to the vehicle computer, while monitoring the oxygen sensor for its reaction to the simulation; and

an oxygen sensor test mode, for performing an oxygen sensor test which forces the engine to run lean without the need for injecting propane thereinto.

4. An oxygen sensor analyzer for use in testing the performance of an oxygen sensor comprising a portion of a vehicle emission system having an on-board computer, the oxygen sensor analyzer comprising:

(a) an electronic circuit having an oxygen sensor input for receiving an oxygen sensor signal from the oxygen sensor with the oxygen sensor disconnected from the on-board computer, a simulate output for connection to the on-board computer in place of the oxygen sensor, and logic means operative for driving the simulate output in:

(i) a closed-loop mode wherein the simulate output directly follows the oxygen sensor input; and

(ii) a simulate mode wherein the simulate output, being isolated from the oxygen sensor input, is driven in an arbitrary manner for forcing the engine to run one or both of lean by driving the simulate output to simulate a rich indication from the oxygen sensor, and rich by driving the simulate output to simulate a lean indication from the oxygen sensor; and

a display for indicating the oxygen sensor signal.

5. The oxygen sensor analyzer of claim 4, wherein the logic means is further operative for:

(a) driving the simulate output in a test mode wherein the simulate output, being isolated from the oxygen sensor input, is driven in a predetermined manner that includes forcing the engine to run lean by driving the simulate output to simulate a rich indication from the oxygen sensor; and

(b) monitoring the oxygen sensor input to measure time-response thereof between conditions of the engine running lean and running rich.

6. The oxygen sensor analyzer of claim 5, wherein the logic means is further operative for signaling a ready condition in the test mode wherein the oxygen sensor input is indicative of the engine having reached a stable lean operating condition, and subsequently enabling the measure of time response when the oxygen sensor input is indicative of engine operation passing from lean toward rich.

7. The oxygen sensor analyzer of claim 6, wherein the oxygen sensor input is responsive over a voltage range including a first predetermined value representing a lean operating condition of the engine, the signaling of the ready condition being inhibited until the sensor input maintains for a predetermined period of time a voltage representing a more lean operating condition than that represented by the first predetermined value.

8. The oxygen sensor analyzer of claim 7, wherein the voltage range is from approximately 0 V representing a most lean operating condition of the engine to approximately 1 V representing a most rich operating condition of the engine, the first predetermined value being approximately 175 mV.

9. The oxygen sensor analyzer of claim 5, wherein the electronic circuit comprises a timer for measuring a passing interval within which the oxygen sensor input changes from a first predetermined value representing a lean operating condition of the engine to a second

predetermined value representing a rich operating condition of the engine, the electronic circuit being operative to signal a passing condition only if the oxygen sensor input reaches the second predetermined value within a predetermined period of time.

10. The oxygen sensor analyzer of claim 4, wherein the display comprises a plurality of indicators, each of the indicators being activated by the electronic circuit continuously in response to the oxygen sensor input in accordance with a predetermined range of the oxygen sensor signal.

11. The oxygen sensor analyzer of claim 10, wherein the oxygen sensor input is responsive over a voltage range of approximately 1 volt and at least one of the indicators is activated when the oxygen sensor input is within the voltage range.

12. A portable oxygen sensor analyzer for use in testing the performance of an oxygen sensor comprising a portion of a vehicle emission system having an on-board computer, the oxygen sensor analyzer comprising:

(a) an electronic circuit having an oxygen sensor input for receiving an oxygen sensor signal from the oxygen sensor, with the oxygen sensor disconnected from the on-board computer, over a voltage range of from approximately 0 V representing a most lean operating condition of the engine to approximately 1 V representing a most rich operating condition of the engine, a simulate output for connection to the on-board computer in place of the oxygen sensor, and logic means operative for driving the simulate output in:

(i) a closed-loop mode wherein the simulate output directly follows the oxygen sensor input;

(ii) a simulate mode wherein the simulate output, being isolated from the oxygen sensor input, is driven in an arbitrary manner for forcing the engine to run one or both of lean by driving the simulate output to simulate a rich indication from the oxygen sensor, and rich by driving the simulate output to simulate a lean indication from the oxygen sensor;

(iii) a test mode wherein the simulate output, being isolated from the oxygen sensor input, is driven in a predetermined manner that includes forcing the engine to run lean by driving the simulate output to simulate a rich indication from the oxygen sensor, the logic means being further operative for signaling a ready condition after the engine reaches a stable lean operating condition as signaled by the oxygen sensor input remaining for a predetermined period of time below a first predetermined value representing a lean operating condition of the engine, and subsequently monitoring the oxygen sensor input to measure time-response thereof between conditions of the engine running lean as signaled by the oxygen sensor input passing the first predetermined value and running rich as signaled by the oxygen sensor reaching a second predetermined value being higher than the first predetermined value; and

(b) a display for continuously indicating the oxygen sensor signal.

13. The oxygen sensor analyzer of claim 12, wherein the first predetermined value is approximately 175 mV and the second predetermined value is approximately 800 mV.

# APPENDIX B
## The Anderson Reference